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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/731,125	12/10/2003	David James Wilson	ALC 3103	4672

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KRAMER & AMADO, P.C.
Suite 240
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Alexandria, VA 22314

EXAMINER

LIE, ANGELA M

ART UNIT	PAPER NUMBER
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2163

SHORTENED STATUTORY PERIOD OF RESPONSE	MAIL DATE	DELIVERY MODE
3 MONTHS	03/28/2007	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

If NO period for reply is specified above, the maximum statutory period will apply and will expire 6 MONTHS from the mailing date of this communication.

Office Action Summary

Application No.

10/731,125

Applicant(s)

WILSON, DAVID JAMES

Examiner

Angela M. Lie

Art Unit

2163

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 09 January 2007.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-30 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-30 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 10 December 2003 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☐ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO/SB/08)
Paper No(s)/Mail Date 10/16/2006.
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____.
- 5) ☐ Notice of Informal Patent Application
- 6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

2. Claims 1-30 are rejected under 35 U.S.C. 103(a) as being unpatentable over Turner et al (US Patent 6018524) in the view of Lin et al (US Patent 6813620).

As to claims 1,13 and 19, Turner teaches a method and apparatus for searching a longest prefix match, comprising the steps of: (a) performing a round of binary LPM searches by executing a plurality of search instances, each search instance searching in a different range of the initial search area (columns 7 and 8, lines 60-67 and 1-9, respectively); (b) in response to the last round of binary LPM searches, defining a new search area by eliminating from further searches, one or more ranges (once it is established if the prefix should be larger or smaller the search is conducted in the respective direction, as described in columns 7 and 8, lines 60-67 and 1-9, respectively); (c) performing a further round of binary LPM searches by executing the plurality of search instances, each search instance searching in a different sub-range of the new search area (Figure 11, tree structure is an example of such a search); (d) in response to the last round of binary LPM searches, defining further a new search area by eliminating, from further searches, one or more sub-ranges (wherein the sub-range is

Art Unit: 2163

considered to be part of previous range); (e) storing a longest match if found in a round of binary LPM searches (column 17, lines 20-24), and (f) if necessary, repeating steps (c) to (e) to further narrow the new search area until either one of the search instances finds a longest matching prefix or all the search areas have been searched, in which case the last longest match becomes the longest matching prefix (as shown in figure 18, if the LMP is not found then the searching algorithm is repeated). Turner does not teach however, that a plurality of search instances is preformed in parallel. Lin teaches a binary search engine method wherein binary searches are executed in parallel (column 1, lines 12-15). It would have been obvious to one of ordinary skill in the art during the time the invention was made, to make a use of Lin's teaching about performing binary search in parallel and adapt it in Turner's search algorithm because this would increase device speed and decrease data packet latency (column 1, lines 55-64).

Note: Claim 19 comprises all the elements of the apparatus, which are essential in order to execute the method disclosed in claims 1 and 13. Similarly, since Turner's and Lin's combined teachings teach all the limitations disclosed in claims 1 and 13, they also inherently teach all the elements disclosed in claim 19.

As to claim 2, Turner teaches the method wherein the database is routing table in a packet forwarding device and the plurality of prefixes are logically sorted in groups in an ascending order of their lengths (column 21, lines 43-48).

As to claims 3, 15 and 24, Turner teaches the method wherein step (a) is performed with search instances starting at predetermined locations within their

Art Unit: 2163

respective ranges (wherein each branch can be interpreted as a respective range), the predetermined locations being about the midpoint (the search starts at the closest midpoint and if value is smaller than the search shifts to the left, again starting at the middle, column 7, lines 60-67, column 8, lines 1-9) in the lowest range and being progressively shifted toward the respective low ends within higher ranges (this will be performed if the prefix will be bigger than middle value, column 7, lines 60-67 and column 8, lines 1-9).

As to claim 4, Turner teaches the method wherein the step of defining the new search area comprises a step of: eliminating those ranges or sub-ranges which contain prefixes shorter than the longest match of the last round of the binary LPM searches (column 8, lines 1-9, if the prefix length is greater than binary search algorithm proceeds further eliminating the shorter lengths).

As to claims 5 and 14, Turner teaches the method wherein the step of performing a further round of binary LPM searched comprises the step of: in response to the last round of binary LPM searches, determining locations within the new search area at which the search instances start the next round of binary LPM searches, directing the search instances which searched the eliminated ranges or sub-ranges in the last round to begin the further round of binary LPM searches at the determined locations/bins of the new search area which contains the last longest match (in the binary search decisions about matching entries are made, and from there new ranges to search are selected, column 7, lines 60-67 and column 8, lines 1-9).

As to claim 6, Turner teaches the method wherein when determining the locations within the new search area, the order of the search instances are maintained (the tree structure has a maintained order so that if the search proceeds it will be conducted in ordered manner, Figure 7).

As to claims 7, 10, 16, 25 and 28, modified teaching of Turner and Lin also teaches the method wherein the step of executing a plurality of search instances in parallel, comprises the step of: issuing parallel memory accesses to several memory banks (Lin, column 2, lines 7-9) at once to access in parallel a plurality of bins (Turner, figure 6) in either the initial or new search area.

As to claims 8, 11, 17, 26 and 29, Lin teaches a method further comprising a step of: issuing several memory accesses to a single memory bank to access in parallel a plurality of bins in either the initial or new search area such that the latencies of these memory accesses overlap (column 13, lines 46-50, there can be more than one table (main memory bank) and each table can be divided into the series of parallel memory banks (bins), which can be searched simultaneously).

As to claims 9, 12, 18, 27 and 30, Turner and Lin teach all the limitations disclosed in claim 3, however Turner alone does not teach the issuing a plurality of prefetch instructions and accessing in parallel a plurality of locations in either the initial or new search area. Lin teaches using cache to store or prefetch some entries at binary boundary and he also teaches parallel search (column 13, lines 46-50). It would have been obvious to one of the ordinary skill in the art during the time the invention was made to use cache to temporally store important information as taught by Lin in Turner's

invention because this would reduce latency or in other words improve performance (column 14, lines 48-63).

As to claim 20, Turner teaches the apparatus wherein the routing table comprises a plurality of bins, each of which contains one or more prefixes of a same length (Figure 6, wherein the bins are the tables with specific lengths, i.e. 1, 2, 3, ...) and may also contain at least one marker (column 7, lines 25-34), the bins being logically sorted in order of their prefix lengths and the initial search area being divided into a plurality of contiguous ranges, each range containing a predetermined number of bins (as shown in figure 6).

As to claim 21, Turner teaches the apparatus wherein each range, bins are preordered for access by the search instances for each round of searches, if no match or marker is found (Figure 6, all the bins are preordered based on the prefix length, column 8).

As to claim 22, Turner teaches the apparatus wherein the ranges contain sufficient number of bins to accommodate a desired number of prefixes in compliance with Ipv6 (column 10, lines 30-37).

As to claim 23, Turner teaches the apparatus wherein the size of the ranges are predetermined so that the worst case memory accesses are evened out across all the ranges (column 10, lines 30-37, since the markers can be shared and the worst case is bound on marker storage, therefore the memory access is evened out).

Response to Arguments

3. Applicant's arguments filed January 9, 2007 have been fully considered but they are not persuasive.
4. With respect to application's assertion on page 12, alleging that Lin does not use a plurality of search instances, in parallel, to perform the same search. The examiner would like to note that the limitations not disclosed in the claim are not given patentable weight. In particular the phrase "same search" is not present in any of the independent claims, better yet, the applicant disclosed in the independent claims 1, 13 and 19, in the step b that the round of the binary LPM searches is carried out.

The Prior Art

5. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.
 - US Publication 20040044868 discloses a method and apparatus for high-speed longest prefix match of keys in a memory using binary search.
 - US Patent 6810037 discloses an apparatus and method for sorted table binary search acceleration.

Conclusion

6. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

7. A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Inquiry

8. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Angela M. Lie whose telephone number is 571-272-8445. The examiner can normally be reached on M-F.

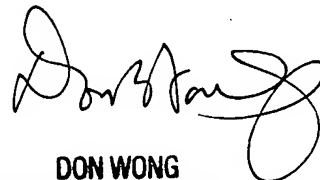
9. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Don Wong can be reached on 571-272-1834. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Art Unit: 2163

10. Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.



Angela M Lie



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